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Editorial

Special Issue on the Internet of Things (IoT) in Smart Cities

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1. Introduction

In recent years, smart cities have significantly developed and greatly expanded their potential. Thanks to advancements in the internet of things (IoT), new possibilities are arising, representing a set of key enabling technologies for smart cities and allowing the production and automation of innovative services and advanced applications for different city stakeholders. Moreover, IoT innovations are leading the smart city paradigm to the big data scale: it has been estimated that the total number of connected IoT devices worldwide will increase to about 75 billion by 2025 [1], creating a potential IoT economic impact that could reach USD 11 trillion per year by 2025 [2]. IoT represents one of the key drivers of smarter innovation and sustainable development, and the IoT integration process in smart city contexts offers great research perspectives and challenges since smart cities are complex socio-technical infrastructures composed of many different stakeholders and users, and digital devices are used in many domains, such as mobility and transportation, environment, energy, healthcare, governance, industry 4.0, smart home and smart buildings, and entertainment. This complexity is reflected in the significant variety of heterogeneous approaches, application domains, scenarios, and technological solutions proposed in the research literature for the realization and management of smart cities [3].

This Special Issue is focused on addressing and highlighting the latest research results on IoT applied to smart city environments. It collects 18 original papers on theoretical and experimental results highlighting recent advances in IoT-enabled smart city contexts, covering a broad range of topics, including healthcare, energy, environment, traffic and mobility, cultural heritage, web security, forensics, and smart warehouses.

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2. Internet of Things (IoT) in Smart Cities

Al-Qarafi et al. [4] introduce a model for energy management in smart cities: artificial jellyfish optimization with a deep-learning-driven decision support system (AJODL-DSSEM), which exploits an attention-based convolutional neural network-bidirectional long short-term memory (CNN-ABLSTM) model for energy forecasting.

Navarro-Alamán et al. [5] propose an IoT smart recommender system, EmotIoT, which predicts future users' emotions using parameters collected from IoT devices to recommend upcoming activities and users' future emotions.

Garlik [6] provides a review of the current state of the art in the management of sustainable energy and smart buildings towards the "near-zero energy buildings" concept, which is required by the European Energy Performance of Buildings (EPB). To this aim, the author also proposes a new EPB model that exploits the integration of IoT, Cloud, and building control systems.

Mitro et al. [7] present a smart solution for cultural heritage, implemented through a distributed smart IoT sensor network (to provide environmental measurements close to monuments) and a visualization platform, and also focused on discussing IoT connectivity and power efficiency aspects. The proposed solution was tested in four cultural heritage sites: the city of Rhodes in Greece, the city of Venice in Italy, the city of Granada in Spain, and the city of Tonsberg in Norway.

Alsaawy et al. [8] describe a framework that addresses the problem of traffic congestion by integrating multiple data sources measuring traffic status with smart tools and services, such as a smart traffic light algorithm to manage congestion at intersections, as well as tweet classification and image-processing algorithms for decision-making.

Ahmed et al. [9] contribute to the development of publicly available labeled datasets in the domain of cyberattacks on Internet of Flying Things (IoFT). To this purpose, they propose the ECU-IoFT dataset, documenting three known cyber attacks targeting Wi-Fi communications and the lack of security in an affordable drone model.

Guan, Wang, and He [10] propose a spectrum resource allocation scheme based on reinforcement learning to maximize the total capacity of Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) links and achieve optimal spectrum allocation, effectively showing maximization of V2V and V2I link capacity.

Goikoetxea-Gonzalez et al. [11] describe a comparative approach for the evaluation of the role that IoT technologies play in the yearly expenses of drivers. To this end, they propose a two-stage methodology to understand the rationale of car expenses by collecting expert opinions through a survey of customers with both connected and non-connected vehicles. The survey results indicated that IoT devices integrated with cars' instrumentation tools lead to significantly fewer expenses regarding maintenance.

Fagbola and Venter [12] discuss the vulnerabilities of IoT shadow devices and connections and how they represent a risk and a challenge for both security and forensic investigations. To this aim, they present the development of a conceptual model for smart digital forensic readiness with shadow IoT devices.

Soe, Ruohomäki, and Patzig [13] propose an Urban Open Platform (UOP) supporting data acquisition, aggregation, and processing, which has been applied in the context of two European capital cities, Helsinki and Tallinn.

Ashfaq et al. [14] present a wearable remote patient monitoring system based on the Internet of Medical Things (IoMT), Artificial Intelligence (AI), and edge computing. The proposed system is used for remote monitoring of cardiovascular patients, implementing a Machine Learning (ML) model that makes inferences about the user's health status, makes predictions based on real-time data, as well as produces alerts and notifications in case of emergency.

Fan et al. [15] describe a method for energy load prediction that combines kernel principal component analysis (KPCA) with kernel extreme learning machine (KELM) optimized by fireworks algorithm (FWA). The KPCA method is exploited to select input features, and the FWA approach is employed to optimize the parameters of KELM. The method is used for load prediction of distributed energy systems.

Sirohi et al. [16] propose a cloud service selection and recommendation system (CS-SR) to find an optimal service based on users' custom requirements by considering both the quantitative and qualitative quality of service (QoS).

Hwang et al. [17] research and investigate the perception of telemedicine for humans through a mobile app providing telemedicine for pets. As a result of the statistical validation tests, users with negative perceptions about pet telemedicine were also found to have negative feelings and insights about telemedicine for humans.

De Nardis et al. [18] conduct a review and assessment of IoT platforms based on the following evaluation criteria: communication protocols, data visualization, data processing, integration with external services and security, installation procedure, and documentation. Over 30 platforms were evaluated, and the FIWARE platform had the overall best performance when considering all the above-mentioned criteria.

Van Geest et al. [19] evaluate the relevant literature about the design of smart warehouses. They applied a systematic literature review to select the reference studies, finding that the motivation and rationale for transitioning to a smart warehouse come from the need to adapt to complex and diverse domains and having to manage challenges such as the management of big data and real-time information. Technologies such as Radio-frequency identification (RFID) and the internet of things (IoT) are needed to turn a warehouse into smart warehouse management systems (WMS) that also support decision-making processes.

Bazargani et al. [20] conduct an overview of GIS and IoT integration and show that the capabilities of GIS in managing and visualizing geospatial data can significantly benefit from real-time data collection and real-time monitoring capabilities provided by IoT devices.

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